



Accredited Africa Training Institute for Capacity Development

Unit FO409, Hatfield Plaza · 1122 Burnett St, Hatfield 0028 · Pretoria, Gauteng · South Africa

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COURSE BROCHURE

Gravity Concentration Process Control Metallurgical Plant Operations Training

Manufacturing, Engineering and Technology / Fabrication and Extraction

Unit Standard 110161 · NQF Level 4 · 17 Credits · 14 Days

COURSE OVERVIEW

This course equips learners with the knowledge and skills to monitor and control gravity concentration processes in metallurgical plant operations. It focuses on process parameters, equipment operation, and quality control to optimize recovery and grade. Participants will be able to apply process control principles and troubleshoot common issues.

Category	Manufacturing, Engineering and Technology
Subfield	Fabrication and Extraction
Unit Standard	110161
Accreditation	SAQA Accredited · NQF Level 4 · 17 Credits
Duration	14 days
Training Method	Online, On-Campus, In-House
Certificate	Issued via AATICD LMS – verifiable online

LEARNING OUTCOMES

- Demonstrate understanding of gravity concentration principles and equipment operation.
- Apply process control strategies to maintain optimal performance in gravity concentration circuits.
- Analyze process data to identify deviations and implement corrective actions.
- Evaluate the impact of feed variations on concentrate grade and recovery.
- Implement safety and quality procedures in accordance with plant standards.
- Monitor and adjust process parameters to achieve target metallurgical performance.

WHO SHOULD ATTEND

- This course is designed for process controllers, plant operators, and metallurgical technicians working in mineral processing plants.
- It is also suitable for supervisors seeking to enhance their understanding of gravity concentration control.

COURSE OUTLINE

Day 1: Introduction to Gravity Concentration and Process Control

- Overview of gravity concentration: principles and applications.
- Types of gravity concentrators: jigs, spirals, shaking tables, dense medium separators.
- Introduction to process control: sensors, actuators, control loops.
- Basic instrumentation: flow, density, level, and pressure measurement.
- Safety protocols in plant operations.
- Quality management systems and standards (ISO, SANS).
- Plant layout and material flow.
- Course structure and assessment criteria.

Day 2: Fundamentals of Slurry and Particle Behaviour

- Slurry rheology: density, viscosity, and yield stress.
- Particle size analysis: sieving, cyclosizer, laser diffraction.
- Settling behaviour: Stokes' law, terminal velocity, hindered settling.
- Stratification mechanisms in gravity concentration.
- Effect of particle shape and liberation.
- Sampling techniques for slurry and solids.
- Laboratory demonstrations: density measurement, settling tests.
- Calculations workshop: mass balance and recovery.

Day 3: Dense Medium Separation (DMS) – Principles and Control

- Dense medium separation theory: sink-float separation.
- Dense medium cyclones: design, operation, and control.
- Dense medium baths: Wemco, Drewboy, and others.
- Medium preparation: magnetite/ferrosilicon, density control.
- Medium recovery: magnetic separators, densifiers.
- Control loops: density, pressure, and level control.
- Troubleshooting common DMS issues.
- Case study: DMS plant optimisation.

Day 4: Jigging – Principles and Process Control

- Jigging theory: pulsation, stratification, and ragging.
- Types of jigs: Baum, Batac, InLine Pressure Jig (IPJ).
- Jig control parameters: stroke length, frequency, water addition.
- Ragging media selection and maintenance.
- Automatic control systems for jigs.
- Performance monitoring: recovery, grade, and efficiency.
- Troubleshooting jig operation.
- Practical example: jig plant data analysis.

Day 5: Spiral Concentrators – Principles and Control

- Spiral concentrator theory: film flow, centrifugal force, and particle separation.
- Spiral design: pitch, diameter, number of turns, trough profile.
- Operating parameters: feed rate, density, splitter position.
- Control of spirals: feed distribution, wash water, splitter settings.
- Multi-stage spiral circuits: rougher, cleaner, scavenger.

- Performance evaluation: grade-recovery curves.
- Troubleshooting: surging, misplacement, wear.
- Case study: spiral plant optimisation.

Day 6: Shaking Tables – Principles and Process Control

- Shaking table theory: differential motion, film flow, and particle stratification.
- Types: Wilfley, Holman, Gemini, and others.
- Operating parameters: tilt angle, stroke length, frequency, wash water.
- Control adjustments for feed variability.
- Table deck covers and riffle patterns.
- Performance monitoring: concentrate, middlings, tailings.
- Troubleshooting common issues: poor separation, wear.
- Practical exercise: table setting optimisation.

Day 7: Process Control Systems – Instrumentation and Automation

- Instrumentation: density gauges, flowmeters, pressure transmitters, level sensors.
- Actuators: control valves, variable speed drives.
- Programmable Logic Controllers (PLCs): architecture and programming basics.
- SCADA systems: data acquisition, HMI, alarm management.
- Control strategies: PID tuning, cascade control, feedforward control.
- Process control diagrams: P&IDs, loop sheets.
- Communication protocols: Profibus, Modbus, OPC.
- Practical: SCADA simulation exercise.

Day 8: Data Analysis and Performance Optimisation

- Data collection: sampling, on-line analysers, plant historians.
- Mass balance calculations: two-product formula, three-product formula.
- Performance indicators: recovery, grade, separation efficiency, E_p .
- Statistical process control (SPC): control charts, capability analysis.
- Optimisation techniques: response surface methodology, design of experiments.
- Software tools: Excel, MATLAB, Python basics.
- Case study: optimising a spiral circuit using data.
- Practical: data analysis workshop.

Day 9: Plant Start-up, Shutdown, and Emergency Procedures

- Start-up procedures: pre-checks, sequence, ramp-up.
- Shutdown procedures: normal and emergency shutdown.
- Emergency response: spills, fires, equipment jams.
- Lockout/tagout (LOTO) procedures.
- Alarm management and troubleshooting.
- Contingency planning: backup equipment, bypass circuits.
- Safety drills and role-playing.
- Practical: simulated start-up and emergency response.

Day 10: Maintenance and Reliability of Gravity Equipment

- Wear mechanisms: abrasion, corrosion, erosion.
- Maintenance of jigs: ragging replacement, screen decks.
- Maintenance of spirals: splitters, liners.

- Maintenance of shaking tables: deck covers, drive mechanisms.
- Maintenance of DMS equipment: cyclones, pumps, magnetic separators.
- Condition monitoring: vibration analysis, thermography, oil analysis.
- Preventive maintenance scheduling.
- Reliability-centred maintenance (RCM) principles.

Day 11: Water Management and Tailings Disposal

- Water balance: sources, usage, losses.
- Water treatment: clarification, flocculation, filtration.
- Water recycling: thickeners, ponds, reuse.
- Tailings disposal: conventional, paste, dry stacking.
- Environmental regulations and compliance.
- Tailings dam management and monitoring.
- Water conservation strategies.
- Case study: water optimisation in a gravity plant.

Day 12: Advanced Control Strategies and Optimisation

- Advanced process control (APC): overview.
- Model predictive control (MPC): principles and applications.
- Expert systems and fuzzy logic in mineral processing.
- Multivariable control and decoupling.
- Optimisation of integrated circuits: spiral-jig-table combinations.
- Real-time optimisation (RTO) concepts.
- Software implementation: DCS, APC packages.
- Practical: simulation of advanced control.

Day 13: Quality Control and Assurance

- Quality control in mineral processing: sampling, assaying.
- Statistical quality control: control charts, acceptance sampling.
- Quality assurance: ISO 9001, SANS standards.
- Internal and external audits.
- Non-conformance management and corrective actions.
- Continuous improvement: PDCA cycle, Six Sigma.
- Case study: implementing QC in a gravity plant.
- Practical: quality control exercise.

Day 14: Integration, Review, and Assessment

- Integration of process control across the gravity circuit.
- Review of key learning points from all days.
- Final assessment: written test and practical demonstration.
- Feedback and discussion.
- Action planning: applying learning to own plant.
- Course evaluation.
- Certification and close-out.
- Networking and resources.

ASSESSMENT & CERTIFICATION

Delegates are assessed through exercises and a final test. A mark of **50% or above** earns an **AATICD Certificate of Completion**, issued digitally with a unique verification code. This course carries **17 NQF credits** at **NQF Level 4**.

PRICING (PER DELEGATE, EX-VAT)

Delegates	Training Method	Price per Delegate	Total
1	Online	R 46,100.00	R 46,100.00
1	In-House	R 59,900.00	R 59,900.00
1	On-Campus (Pretoria)	R 69,200.00	R 69,200.00

UPCOMING SESSIONS

Start	End	Method	Venue
04 Aug 2026	21 Aug 2026	On-Campus	Cape Town, South Africa
05 Aug 2026	24 Aug 2026	On-Campus	Dubai, UAE
06 Aug 2026	25 Aug 2026	On-Campus	Pretoria, South Africa
06 Aug 2026	25 Aug 2026	On-Campus	Lagos, Nigeria
07 Aug 2026	26 Aug 2026	On-Campus	Johannesburg, South Africa
10 Aug 2026	27 Aug 2026	On-Campus	Cape Town, South Africa
11 Aug 2026	28 Aug 2026	On-Campus	Dubai, UAE
12 Aug 2026	31 Aug 2026	On-Campus	Pretoria, South Africa

Contact us if no suitable date is listed – on-demand sessions can be arranged for groups.

HOW TO GET A QUOTE OR APPLY

- 1. Get an instant quotation online:** visit www.aaticd.co.za, open the page for this course (Unit Standard 110161) and click **Get A Quote / Apply**. Select your training method and number of delegates – your quotation is generated immediately and emailed to you with the course brochure attached.
- 2. Apply by email:** send the course title, your preferred training method (Online, In-House or On-Campus Pretoria), the number of delegates and your preferred dates to apply@aaticd.co.za – our team will reply with a formal quotation.
- 3. Apply by phone or WhatsApp:** call **+27 12 004 8389** or WhatsApp **+27 65 077 6310** and we will prepare your quotation and reserve your seats.
- 4. Confirm your booking:** accept the quotation and settle the invoice. As soon as payment is confirmed your delegates are enrolled and receive their AATICD LMS login details by email, along with joining instructions for their chosen training method.

Group discounts apply automatically – the more delegates you enrol, the lower the price per delegate. No payment is required to request a quotation.

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